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DEPARTMENT OF COMMERCE

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MINING METHODS AND COSTS AT THE CENTRAL-EUREKA MINE, AMADOR COUNTY, CALIF.

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JAMES SPIERS

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MINING METHODS AND COSTS AT THE CENTRAL-EUREKA MINE, AMADOR COUNTY, CALIF.[1]

By James Spiers[2]

INTRODUCTION

This paper describing the mining practice at the Central-Eureka mine is one of a series of similar papers being prepared by the United States Bureau of Mines on mining practices, methods, and costs in the various mining districts of the United States. The mining practices described in this paper are illustrative of the methods employed in the exploitation of comparatively low-grade gold ores under the extremely heavy and swelling ground conditions which occur in the Mother Lode belt of California.

The Central-Eureka Mining Co. comprises a group of adjoining mines in Amador County near Sutter Creek. The principal mines of the consolidated group are the Central-Eureka, formerly known as the Summit mine, and the Old Eureka mine, which is also known as the Hayward Quartz mine. The group is situated in the most productive part of the main Mother Lode belt, the 10-mile portion which lies between the towns of Plymouth and Jackson. The three largest producing mines of the entire belt at the present time are the Argonaut, Kennedy, and the Central-Eureka; these lie within a radius of less than 1-1/2 miles.

The grade of the ore in the Central-Eureka mine varies from $4 to $20 per ton. An average of 160 tons per day is mined from narrow veins under exceptionally heavy ground conditions by square-setting and filling. The ore is treated in the company-owned 40-stamp mill by amalgamation in the batteries and on plates, and by concentration on Frue vanners. An average of 85 per cent of the gold recovered is amalgamated and the remaining 15 per cent obtained in the pyrite concentrates. The concentrates represent about 2 per cent of the ore and range in value from $70 to $90 per ton. The sulphide concentrates are cyanided locally under contract.

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1 - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6512."

2 - Superintendent, Central-Eureka Mining Co., and one of the consulting engineers, U. S. Bureau of Mines.

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Electric power for mining and milling is purchased from a power company at a rate of approximately nine-tenths of a cent per kilowatt hour. Most of the timber used in mining is cut on company-owned lands during the winter months.

The Central-Eureka Mining Co. employs a crew of 150 men, including underground and surface labor at both mine and mill.

ACKNOWLEDGMENTS

The author acknowledges the courtesy of Albion S. Howe, manager of the Central-Eureka Mining Co., for permission to write this paper, and the assistance of William O. Vanderburg,[3] who collaborated in the preparation of the data herein presented.

HISTORY

The Summit mine was located in 1855, and 11 years later a shaft was sunk to a depth of 550 feet. About 1,000 tons of commercial ore was taken out, but as the bottom workings offered no encouragement for further sinking the mine was closed down and the machinery dismantled and sold. In 1893 the Summit property was sold for $6,000 and incorporated under the name of the Central-Eureka Mining Co. Since 1893, with the exception of several minor shutdowns, operations have been continuous to the present time.

The Hayward Quartz mine, one of the most famous of the Mother Lode mines, was first opened in 1852. In 1886, when the mine had attained a depth of about 2,000 feet, and after having produced about $16,000,000, it was closed and remained idle for a period of 30 years. In 1916 a new company purchased the property for $500,000 in cash. This company reopened the old shaft and extended it to a depth of 3,500 feet inclined distance (3,212 feet vertical), and drove several new levels without finding commercial ore in payable quantities; work was discontinued in 1921. In 1924 the property was purchased by the Central-Eureka Mining Co. This purchase avoided possible expensive litigation.

The total production of the Central-Eureka Mining Co. from 1896 to the present time has been about $10,000,000.

GEOLOGY

A number of papers describing the geology of the Mother Lode belt and its mines have been published, the most recent of which was written by Adolph Knopf.[4]

The formations with which the veins are associated in the Central-Eureka properties consist principally of slate and meta-andesite, the latter being locally called greenstone (see fig. 1). Above the 1,000-foot elevation

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3 - Associate mining engineer, U. S. Bureau of Mines.

4 - Knopf, Adolph, The Mother Lode System: U. S. Geol. Survey Prof. Paper 157, 1929, 88 pp.

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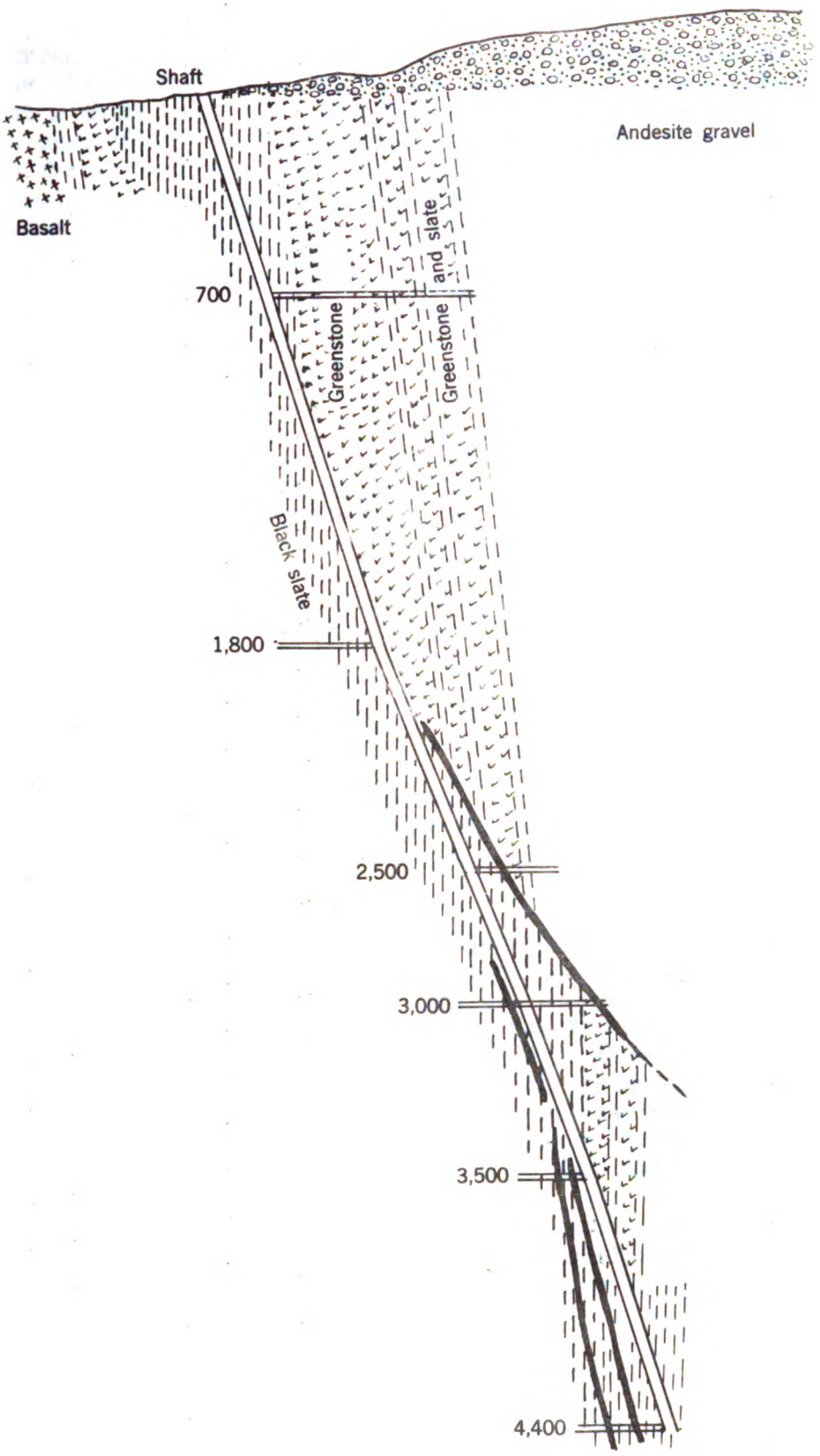

Figure 1.—Section through Central Eureka shaft

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of the Central-Eureka mine the so-called "contact vein" was enclosed in slate walls; below the 1,000-foot elevation the hanging-wall slate changed to greenstone. At a depth of about 3,300 feet the "contact vein" became too low-grade to mine profitably. On the 3,500-foot level a new ore shoot was discovered in the footwall of the "contact vein" from which, until recent months, the ore production was taken. The intervening rock between the two veins is slate, which varies in thickness from 30 to 70 feet.

The slates in proximity to the veins are intensely corrugated and their foliation surfaces have taken on a smooth black polish; this structure is so weak that artificial support is required in the mine openings. The greenstones adjacent to the veins have been shattered and subsequently filled with quartz, forming a stockwork of quartz veinlets.

The gold occurs as "free gold" embedded in quartz, or intergrown with sulphides, generally pyrite, but also minor amounts of arsenopyrite and galena. It is commonly present as visible particles or small masses. Not all of the gold is confined to the quartz veins, as ore is sometimes found in the wall rocks. The mineralization in the greenstone constitutes what is locally called "gray ore." Gold values in sufficient quantity to make commercial ore are also found in some places in wall gouges.

The vein filling is mostly quartz. Owing to the intercalation of slate slabs it presents a banded structure, parallel to the walls of the vein. The veins so far worked have invariably been accompanied by gouge ranging from a few inches to 8 feet thick on either or both walls. This gouge causes the ground to swell and necessitates heavy timbering of the stopes. In some places timbers up to 24 inches in diameter are splintered and broken by the tremendous pressure of the moving and swelling ground within a few weeks after being placed in position.

In general it may be stated that the mining method is determined by the following factors: (1) Heavy gouge occurs on either or both walls of the veins; (2) the walls proper are traversed by slickensides and are structurally weak; (3) the vein material, consisting of quartz with intercalated bands of slate, is also structurally weak and crushed to such an extent that in some places spiling must be resorted to for holding the ground; (4) the veins dip from 50 to 80°; (5) the width of the veins ranges from 1 foot to a maximum of 35 feet; the average width mined at the present time is about 5 feet. The length of the ore shoots ranges from 50 to 400 feet.

Deep mining is favored by the low rate of increase of rock temperature with depth. The geothermal gradient at the Central-Eureka mine measured over a vertical range of 4,095 feet is 160 feet per degree Fahrenheit.

EXPLORATION

In the early days, exploration was done by means of surface trenching and shallow shafts. Exploration work is now carried on by means of underground openings: shafts, crosscuts, and drifts. Long haulage crosscuts are not required because the main inclined shaft was originally located to follow the dip of the veins on the hanging-wall side, and the ore shoots have no definite rake.

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When drifts encounter changes in formation, crosscuts are driven into the walls to explore for parallel fissures. In the stopes, the crosscuts into both walls for the purpose of providing filling are driven far enough to find any such parallel veins.

Long holes are drilled from the drifts into the walls normal to the dip at 5-foot intervals for testing purposes.

Diamond drilling has been tried but because of the broken-up charact. of the formation, the low core recovery, and the likelihood of obtaining misleading information due to the manner in which the values are distributed, this method of exploration has not proved satisfactory.

SAMPLING AND ESTIMATING

Hand-sampling is relied upon almost entirely to determine which portions of the ore shoots are ore. The gold values are not uniformly distributed and the quartz is not indicative of the gold present. Some of the best ore mined in the past showed no quartz but occurred in the greenstone and slate.

The faces of horizontal development workings are sampled daily by means of a hand pick, a method which has been found satisfactory as the ground is usually soft and can be picked readily. A face sample is taken by picking channels across the width of the vein or the face, the picked material being caught in one hand and transferred to a canvas sample sack until about a 5-pound sample is obtained. The channels are several inches wide and about an inch deep. If the vein is made up of several layers of quartz showing different characteristics, samples of the individual layers are cut separately and averaged for the full width of the vein. Daily stope samples are taken in the same manner. In raises, where it is difficult to cut a sample from the face, grab samples are taken at the chutes, these being the only chute samples taken in the mine.

Car samples are taken of the ore trammed from the Old Eureka mine to the Central-Eureka shaft, and from the tram cars carrying ore from the shaft to the mill. A mill heads sample is taken from the feeder in the mill. Following the monthly mill clean-up, these mill heads samples are checked against the actual mill returns, with correction for tailing losses.

All assays are recorded serially on loose-leaf forms which show the serial number of the assay, the date of the sample, its location, the character of the rock, as quartz, slate, or gouge, the width of the sample, and the value. These assays are next segregated to similar record sheets for each working place, so that the assay record of any place is readily available. Finally, the assays are recorded on stope floor maps which show the location, character of material, width and assay value of the samples.

Estimates of ore reserves can not be made with a reasonable degree of accuracy because of the manner in which the values are distributed, and the large amount of development work that would be required. Because of the heavy ground conditions and the consequent large outlay necessary for maintenance of mine openings, the ore is not blocked out very far in advance of actual mining operations.

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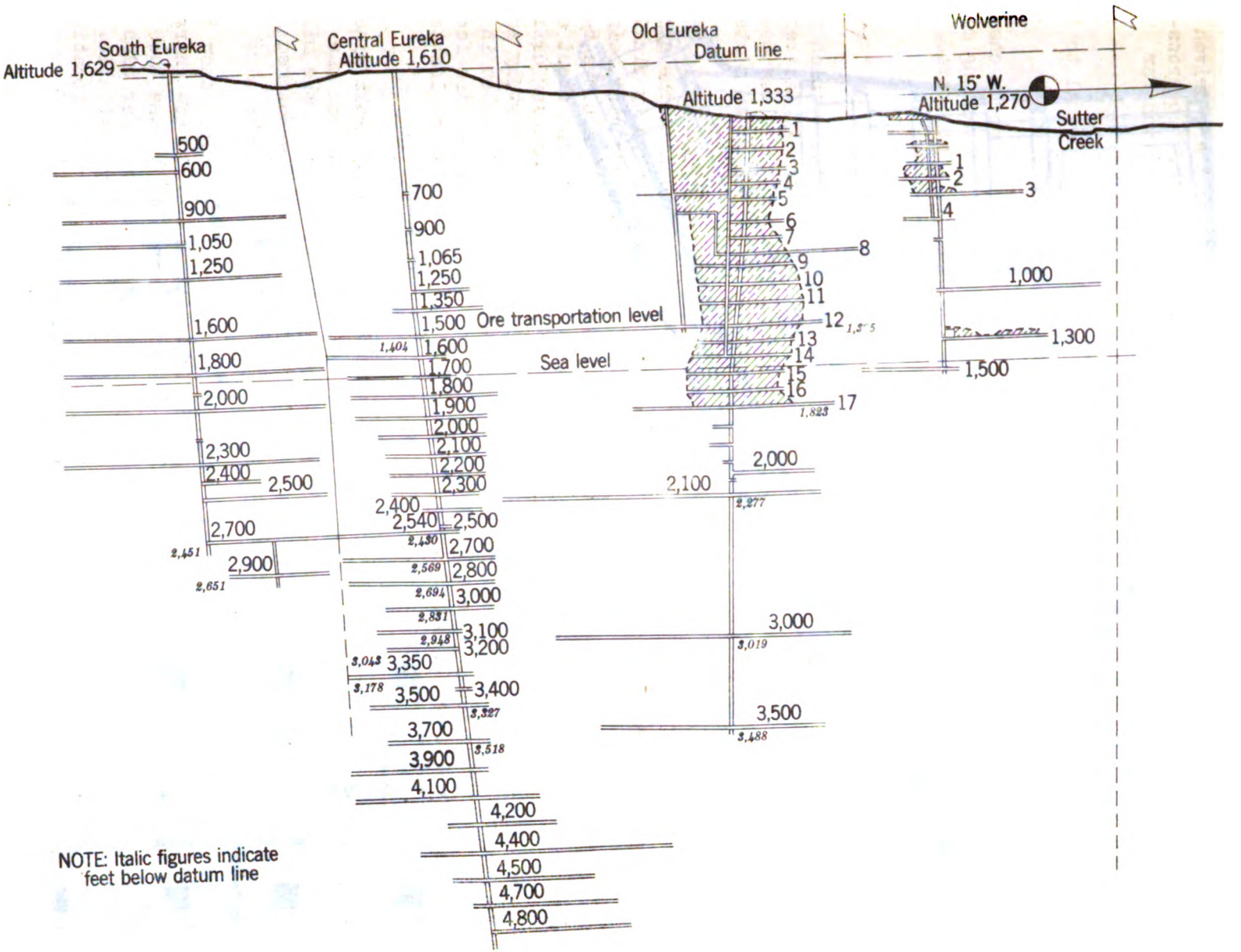

Figure 2.–Longitudinal section of Central Eureka and adjoining mines

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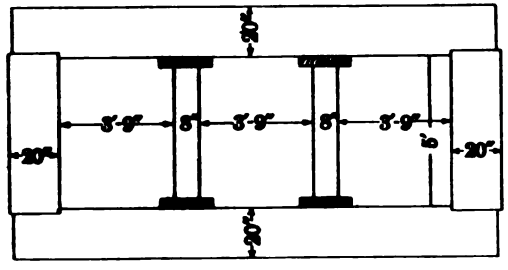

Figure 3.—Main hoisting shaft, timber framing details

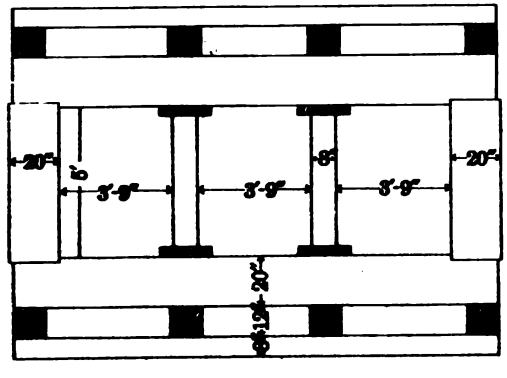

Figure 4.—Jacketed shaft set

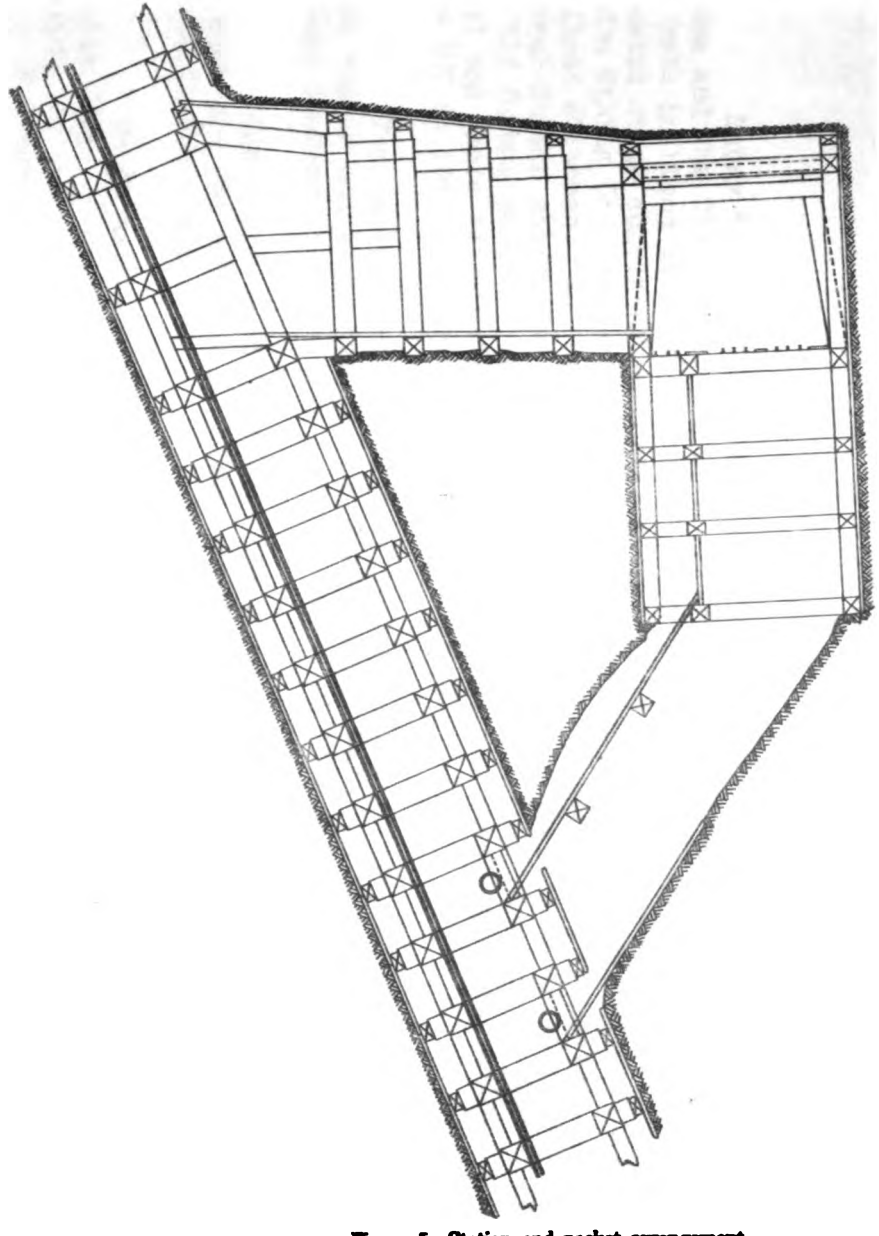

Figure 5.—Station and pocket arrangement

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DEVELOPMENT

Shafts

Entry to the mine workings is made by two shafts, the Central-Eureka and the Old Eureka, 4,800 and 3,500 feet in length, respectively, and both inclined at an angle of 70°. In addition the South Eureka shaft situated on an adjoining property, now idle, is kept in repair by the Central-Eureka Mining Co. for ventilation and pumping. This shaft is 2,700 feet deep, inclined distance. All ore mined is hoisted to the surface through the Central-Eureka shaft. At the present time, most of the ore is derived from the Old Eureka property below the 1,200-foot level; it is hoisted to that level and there transported to the main shaft. The level interval varies from 100 to 150 feet vertical distance (fig. 2).

The Central-Eureka shaft is timbered with spruce, which is a long fibre timber and lasts longer than Oregon fir. Wall and end plates are made of logs slabbed on four sides and from 20 to 24 inches in cross section.

The shaft is divided into three compartments, two of which serve as skipways and the other as a manway. Each compartment is 3 feet 9 inches by 5 feet in the clear.

Shaft sets are placed at 5-foot centers. The shaft timber-framing details (fig. 3) are relatively simple compared with other types of shaft framing, as only the wall plates are dapped 2 inches at the ends. The simple style of framing preserves the original strength of the timber without the weakening produced by elaborate joint details, and the ground pressure is sufficient to hold the members of the sets in position without danger of their dropping out. The method of framing has been found to be satisfactory under the heavy ground conditions at the Central-Eureka.

Exceptionally heavy and loose ground was encountered between the 4,500 and 4,800-foot levels of the main shaft and in this area the shaft sets are jacketed on the hanging wall and footwall sides (fig. 4). The jacketed sets are lagged tightly with split lagging spanning two sets to prevent the ground from running. The principal advantage in the use of the jacketed sets is the possibility of making repairs in the shaft or relieving the ground pressure without interfering with hoisting operations.

The inside or floating sets can be kept in alignment by changing the length of the blocking between the sets and jacking the inner set back in position, but the usual method is to keep the blocks of standard length and jack both sets into alignment after relieving the pressure by taking out ground.

The Old Eureka shaft also has three compartments and is timbered with the same type of shaft sets as described. This shaft was idle for 9 years and the bottom portion of it, which has closed completely because of the ground pressure, is now being reopened. The timbers in the upper part of this shaft were originally hand-hewn oak, 20 to 26 inches square, and where these timbers have not broken they are still in an excellent state of preservation after more than 60 years of service.

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The station timbering (fig. 5) conforms with standard practice elsewhere except perhaps for one feature. For ease in loading timbers on the trucks the station platform is elevated about a foot above the top of the rails in the haulageway.

Drifts and Crosscuts

On the lower levels the ground is heavy and practically all workings are timbered. Crosscuts from the shaft to the veins and drifts in the veins are timbered with round spruce timber 12 to 16 inches in diameter, and are 5 by 8 feet in section inside the timbers (fig. 6). The sets are placed 5 feet center to center.

When the drift is in ore a bridge is used above the set as shown in Figure 7. The floor of the stope is started from the top of the bridging rather than directly above the drift set timber. This arrangement permits removal of broken drift sets without disturbing the stope fill. The pressure from the walls is usually sufficient to hold the bridge cap and the floor of the stope in place when it is necessary to remove a drift set.

Drifts are driven on the veins. Little difference exists in the ground pressure in the wall rocks as compared with that in the veins, and consequently the expense of maintaining drifts in a vein or parallel to it in either wall would be about the same in both cases. Moreover, the strike of the veins varies to such an extent that difficulty would be experienced in keeping drifts parallel to them. The veins being mined at the present time are usually less than 8 feet in width and the full width of the ore is taken. If the vein is wide the drift is driven along the hanging wall.

The destruction of timber in the Central-Eureka mine is caused almost entirely by heavy pressure; breakage occurs long before the wood is weakened by decay. Numerous slips and fracture zones are encountered which require the drift timbers to be carefully blocked and wedged. In places where swelling ground is encountered bridged sets are used. Sills can not be used under the posts because swelling ground would then lift the track.

All drifts are driven on company account by crews of two men on each of two shifts. These crews on both shifts do all the work necessary to advance the heading.

Raises

Two-compartment ventilation raises are driven from level to level before stoping begins. In addition to their ventilation and exploration value, these raises are later used as starting points for stoping and sometimes for dropping waste fill into the stopes.

Raises are also carried up in the stopes as they advance. These raises may have either one or two compartments. The single compartment raises serve as ore chutes. They are 4 feet by 5 feet in section and cribbed with round timbers 10 to 12 inches in diameter slabbed on two sides (fig. 8). The end plates are placed at right angles to the wall of the vein.

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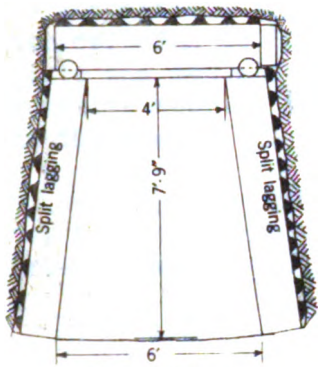


Figure 6.—Drift set

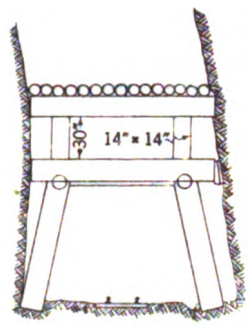


Figure 7.—Drift timbering under stopes

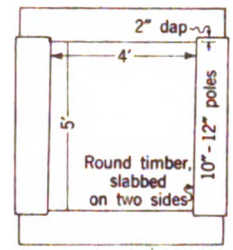


Figure 8.—Cribbed chute

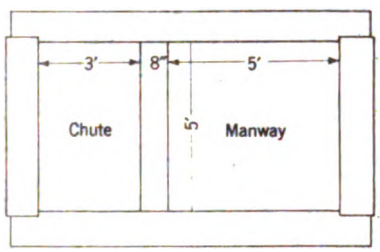
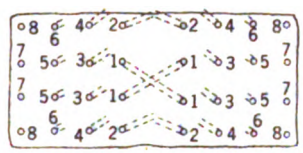


Figure 9.—Cribbed chute, and manway



NOTE: Numbers indicate order of firing

Figure 10.—Plan of 32-hole shaft round

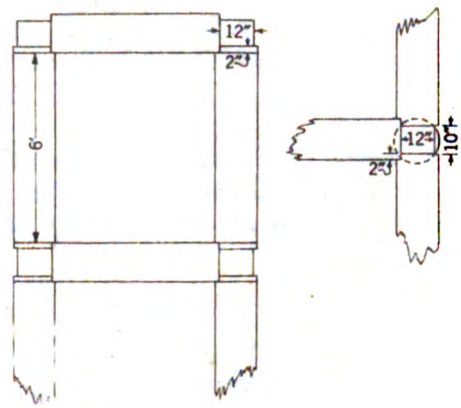


Figure 11.—Square-set for narrow vein

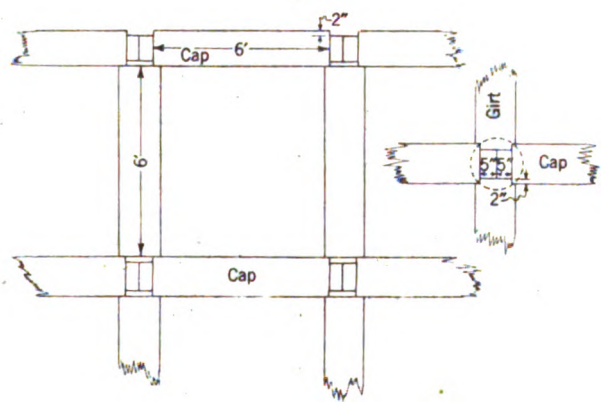


Figure 12.—Square-set for wide vein

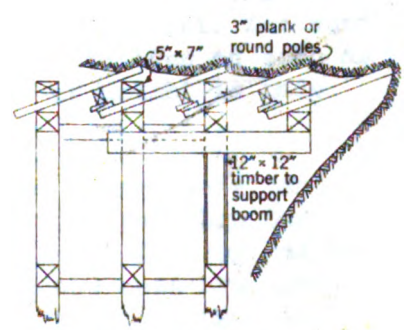


Figure 13.—Method of using spiling in soft or running ground

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The two-compartment raises are of similar construction (fig. 9). The chute compartment is 5 by 3 feet and the manway 5 by 5 feet in the clear. The center cribbing is lined with 2-inch plank to prevent small rocks working through into the manway. The chutes are unlined, excepting where sharp bends cause excessive wear on the timber. Chutes are kept full of ore when possible to reduce the wear.

Usually the cribbing extends from wall to wall of the vein. Where the ore is wide the raises are carried up in the square-sets by lagging off two square-sets with split lagging to form a manway and a chute.

Drilling and Blasting

Hand-held jackhammers with 7/8-inch hollow hexagonal steel are used for shaft sinking; Leyner machines with 1-1/4-inch hollow round steel are used in drifting and crosscutting; hand-rotated stoper machines with 1-inch quarter-octagon steel are used in raising and stoping. Standard double-taper cross bits with a change in gage of 1/8-inch for each 1 foot increase in the length of the steel are employed. The maximum length of steel is 7 feet.

The type of round used in shaft sinking is shown in Figure 10. Because of the variable nature of the ground no standard rounds are employed in raises, drifts, or crosscuts. In drifting, the machine is mounted on a 3-1/2-inch column with a cross arm.

Low-freezing gelatin of 40 per cent strength in 1-1/8 by 8 inch cartridges is used in breaking. Electric detonators are used in shaft sinking, and in all other work triple-taped fuse and No. 6 detonators are used.

Air pressure of 100 pounds per square inch at the compressor is used for drilling. Drilling water is taken from behind dams on the upper levels or from the water column in the shaft.

STOPING

Due to the heavy ground conditions practically all ore at the Central-Eureka properties is extracted by overhand stoping using square-sets for support in conjunction with waste filling. Timbers are placed in position as soon as room is available and no opening over two sets (16 feet) in height is made without filling with waste.

Native "mountain pine" round timber is used for square-sets, and ranges from 10 to 16 inches in diameter. This timber is cheaper than the spruce used for timbering permanent openings, but lasts until filling can be placed to take the weight. Two styles of framing the square-sets are used, depending on the minable width of the vein. The style of framing used in veins not over 8 feet in width is shown in Figure 11. The caps range from 6 to 8 feet in length, and the posts are either 6 feet or 7 feet 6 inches in length. Girtwise the sets are spaced on 5-foot centers.

The standard square-set framing for wide veins is shown in Figure 12. The overall length of the caps is 6 feet, of the posts 6 feet or 7 feet

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6 inches, and of the girts 4 feet 4 inches. The sets are spaced 5 feet center to center along the vein.

The ventilating raises from level to level are generally used as starting points for each new stope floor. Stope sections are usually 75 feet long, although this figure is variable, and sometimes floors are opened for twice the distance. No pillars are left between sections, and all known ore is removed, excepting shaft pillars.

The sill floor is started from the top of the bridging above the drift timbers. The floor for holding the fill consists of round lagging about 5 inches in diameter. Chutes are spaced at intervals of 25 feet with manways at every third chute, as shown in Figure 14. The chutes and manways are cribbed as described under the section on development, and are carried upward as the mining proceeds. The manways of all two-compartment raises are provided with compressed air hoists using 5/16-inch steel cable. The footwall side of the raise is floored with 2-inch plank for the loads to slide on, and all timber, steel, and drills are thus hoisted into the stopes.

All raises through the stope are kept open until stoping is finished, after which only the raise nearest the shaft is maintained for safety and ventilation purposes.

Chutes are covered with grizzlies of 10-inch round timber spaced 6 inches apart.

Practically all stope drilling is done with hand-rotated stoper drills. A Leyner machine mounted on a column is used on rare occasions, and jackhammers are used to break boulders and sometimes to cut hitches for timbering.

All shoveling in the stopes is done by hand. This controls the spacing of chutes; the customary 25-foot interval requires shoveling the ore not over half that distance. Wooden shoveling floors or sheet-iron plates are laid before blasting.

Waste filling is obtained chiefly by driving chambers in either the hanging wall or the footwall, depending on the firmness of either wall. As stated previously, these openings have an exploratory value, and the strongest point in the wall is selected for them, to avoid caving. They are started as small in cross section as possible, to avoid seriously weakening the stope walls, and are enlarged as they go away from the stope. These waste chambers are usually driven as raises inclined at about 50°. The waste thus obtained is run into the stopes as much as possible by gravity; the final leveling off is done by hand.

Frequently when development work on the level above produces rock of too low a grade for the mill, this material is dropped into the stope through the chute compartment of the ventilation raise and used for stope filling.

Some sorting is done in the stopes when it has been necessary to break down barren or low-grade material from the hanging wall with the ore.

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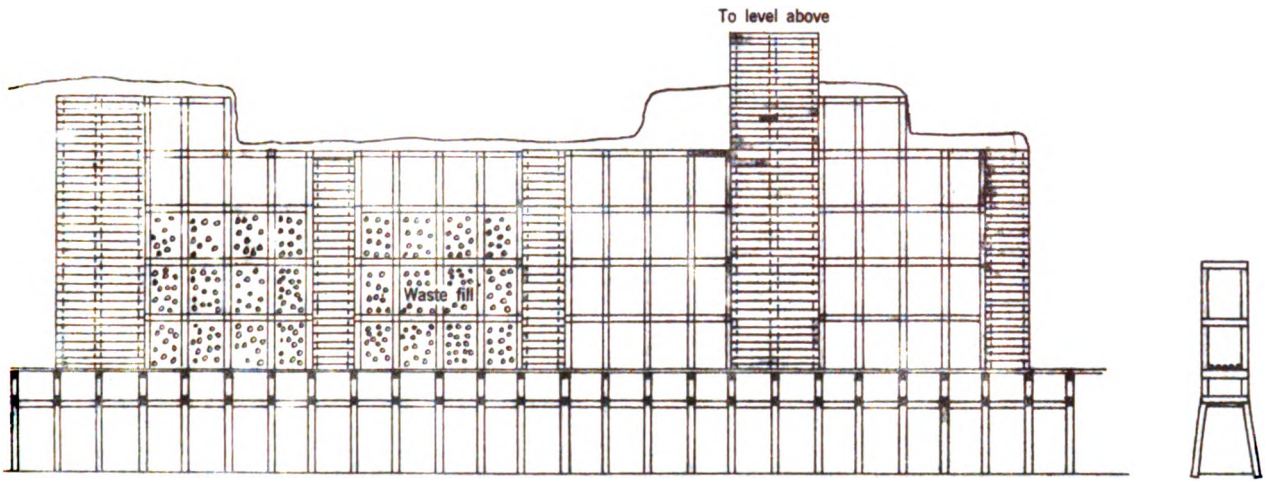

Figure 14.– Narrow stope, longitudinal arrangement

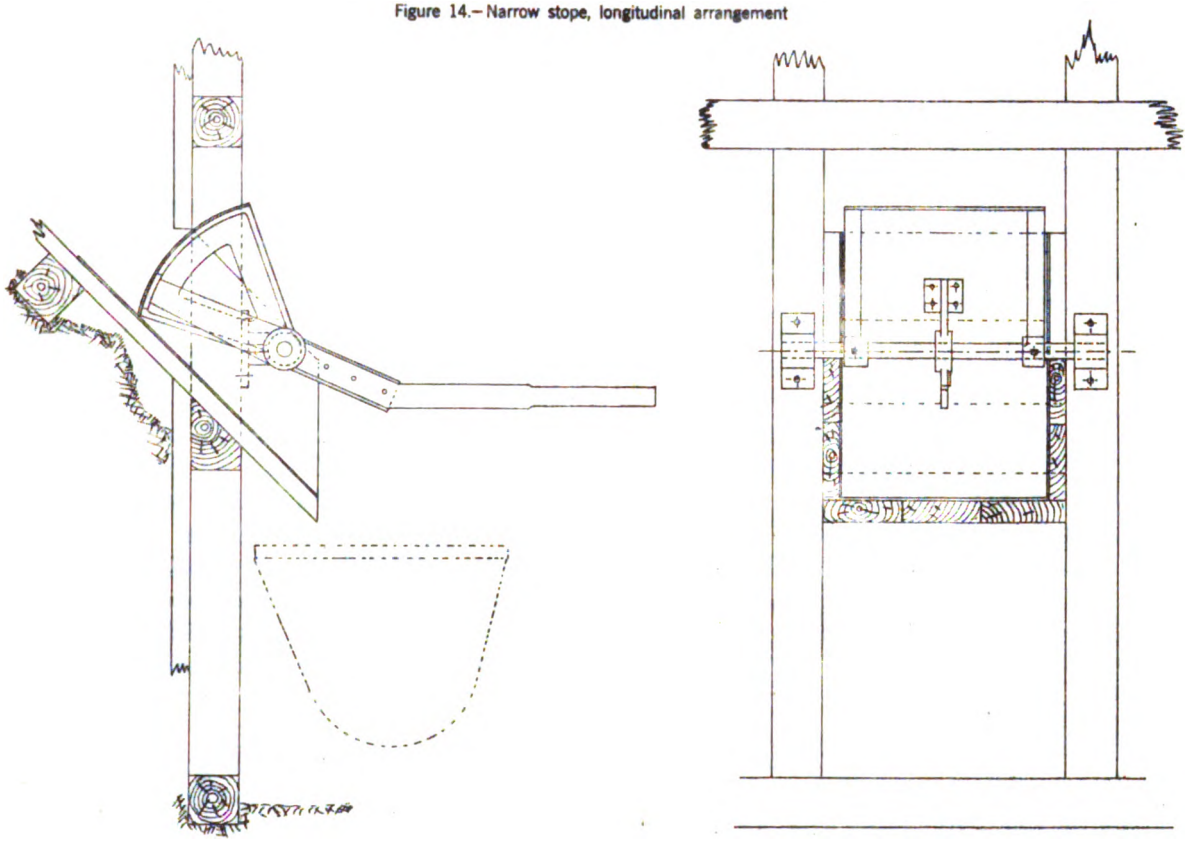

Figure 15.– Loading chute with arc gate

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This provides a small amount of waste for filling. No other hand-sorting is done underground or at the surface.

In some cases the ore is soft running ground and in this event its extraction is a more serious problem. A system of spiling is employed in conjunction with the square-set timbering. Spiling consisting of 3-inch plank or round poles is driven over the caps by means of hand sledges and are held in position against the back by booms, as shown in Figure 13. The ends of the spiling timber are not sharpened; the spiling is worked into the ground by driving with sledges and by picking the loose ground away from before the ends. In some places side spiling and breast boards are also required to prevent the ground from running.

A miner and a helper constitute a stope crew at each face. These men do both the drilling and the timbering.

To prevent "high-grading," guards or watchmen are placed in some rich stopes, and these stopes are worked only on day shift. No change-house system or precautions are observed, other than supervision by the change-house man.

TRANSPORTATION

The ore is drawn from chutes of the ordinary timber and plank construction into cars of 16-cubic feet or about 0.8-ton capacity, and hand-trammed to the shaft bins. Cars are equipped with roller bearings and alemite connections for greasing, and are regularly inspected and greased every two weeks. All track underground for hand tramming consists of 16-pound rails with a gage of 18 inches; it is laid to a grade of 0.4 per cent. Ties are of untreated Oregon fir 4 by 6 inches in section and 30 inches in length.

The ore from the Old Eureka workings is transported to the main shaft underground on the 1,200-foot level by a storage-battery locomotive. The locomotive is rated at 3.8 hp., weighs 1-1/2 tons, and is driven by spur-gear drive. The starting draw-bar pull is 600 pounds; when running at a speed of 4-1/2 miles per hour the draw-bar pull is 400 pounds. A train consists of six side-dumping rocker-type cars each having a capacity of 1 ton. These cars have 12-inch diameter chilled cast-iron wheels with roller bearings and alemite connections for greasing. Figure 15 shows a steel arc gate used at the loading chute where these trains are loaded.

The track for mechanical haulage has 25-pound rails; the maximum curvature is a 15-foot radius curve. The total tramming distance from the Old Eureka to the Central Eureka shaft is 1,800 feet; the average cost when hauling 150 tons per shift is about 3.8 cents per ton.

The skips have a nomical capacity of 3 tons each and are 9 feet long, 25 inches wide, and 3 feet deep over-all. Ten-inch steel wheels are used on the skips and the axle is housed in a continuous box filled with grease.

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Track for the skips consists of 52-pound rails laid to a gage of 27 inches. It is laid directly on the footwall plates of the shaft. At intervals of 100 feet carriers are used to support the rails. The method of clamping the carriers to the wall plates and attaching them to the rails is shown in Figure 16.

For signalling the hoist engineer two bare copper wires are strung on the end plates and on the dividers about 4 inches apart. The wires carry a current of 24 volts and the bells are rung by short-circuiting the wires with a short piece of steel held in the hand.

WAGE SCALE

Most of the work underground is done on company account. The labor turnover from month to month is generally quite high. The wage scale effective at the Central-Eureka Mining Co. in November was as follows:

Hoist engineer	$ 5.50
Surface labor	3.75
Shaft boss	5.25
Shaftman	5.00
Miner	4.50
Miner helper	3.75
Timberman	4.50
Timberman helper	3.75
Trammer	3.75
Shoveler	3.50
Tool nipper	4.50
Pumpman	5.00
Skip tender	4.75
Motorman	5.00

VENTILATION AND SAFETY

Mechanical ventilation is employed to ventilate the deeper portions of the mine. On the 2,700-foot level of the South-Eureka shaft which is on an adjoining property two fans are installed. The larger fan has a capacity of 23,000 cubic feet per minute under a water-gage pressure of 8 inches. This fan is used as a suction fan, and is of the nonoverloading type. The other fan has a capacity of 15,000 cubic feet per minute and operates as a pressure fan against a pressure of 4 inches water gage. The smaller fan is used to reverse the air circuit in case of necessity. The fans are direct-connected respectively to 50 and 25 hp. alternating-current motors.

Compressed air is used to a great extent to ventilate dead ends. To obtain more efficient use of the compressed air and to reduce the amount used a cast-iron blower attachment (fig. 17) is connected to the compressed-air line.

A first-aid man employed by the company gives training in first-aid to picked men once each month. Five sets of Burrell breathing apparatus are kept in condition for immediate use at the mine; training in the use of

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this apparatus is renewed once each month. In addition a cooperative station with a full complement of rescue apparatus is maintained at the Central-Eureka property.

Drinking water for mine use is taken from a spring on the 700-foot level of the Central-Eureka mine; the water carried to each shaft station below the 700-foot level in 3/4-inch pipe lines. The type of homemade drinking fountain connected to the line at each level is shown in Figure 18. The pressure in the pipe line is reduced at each level to prevent bursting of the pipe.

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Table 1. - Details of costs in units of labor, power, and supplies

Old Eureka mine — Period: Month of September, 1930
Ore mines: 4,143 tons — Mining method: Square-sets with waste fill

Labor (man-hours per ton)	
Superintendence	0.011
Shaftmen (repair)	.343
Miners and timbermen	1.483
Miners and timbermen helpers	.993
Trammers	.375
Shovelers	.270
Skiptenders and hoist engineers	.361
Miscellaneous underground	.058
Topman	.175
Motorman	.050
Surface labor[1]	.419
Total	4.538
Average tons per man per shift (all men chargeable to underground operation)	1.76
Explosives (pounds per ton, 40 per cent strength, low-freezing gelatin)	1.01
Fuse (feet per ton)	3.80
Caps (number per ton)	6.58
Timber (sawed stock, board feet per ton)	7.70
Logs (board feet per ton)[2]	18.08
Total (board feet per ton)	25.78
Power (kw. h. per ton)	86.0
Other supplies in percentage of total power and supplies	17.4
Labor, percentage of total cost	69.3
Power and supplies, percentage of total cost	30.7

1/ Includes electrician, blacksmiths, timberframers, master mechanics and watchman.
2/ Round timber reduced to board feet by Scribner's rule.

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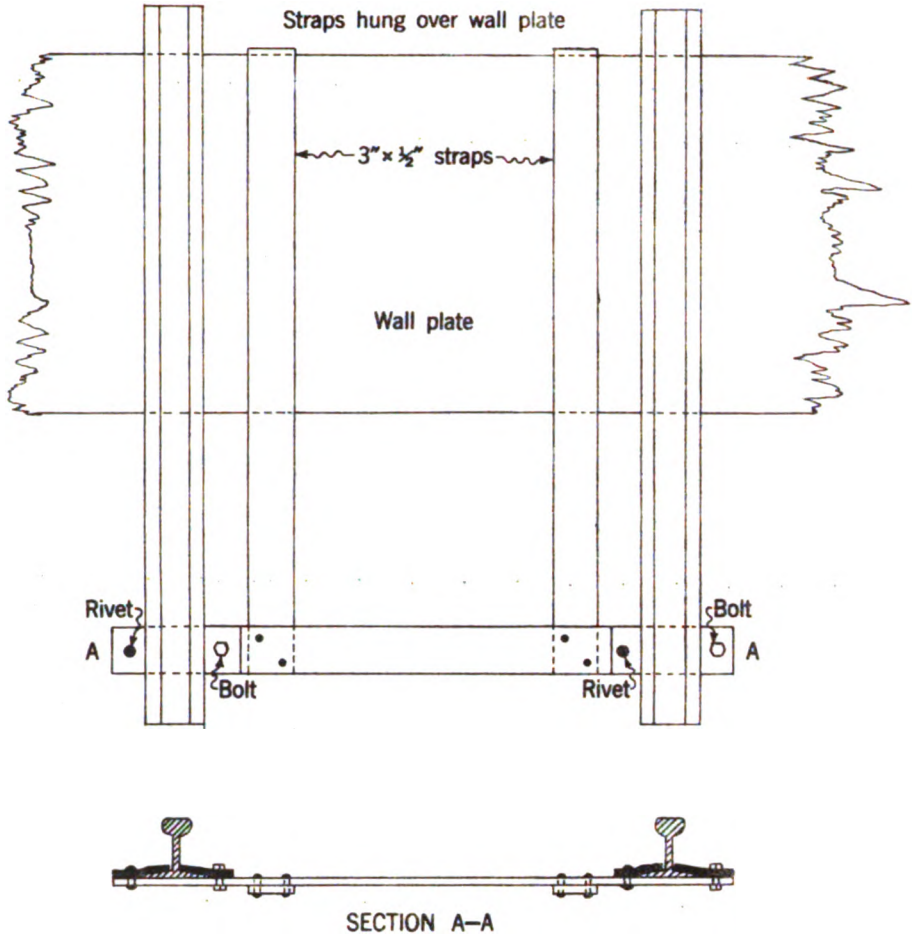

Figure 16.– Rail carrier for inclined shaft

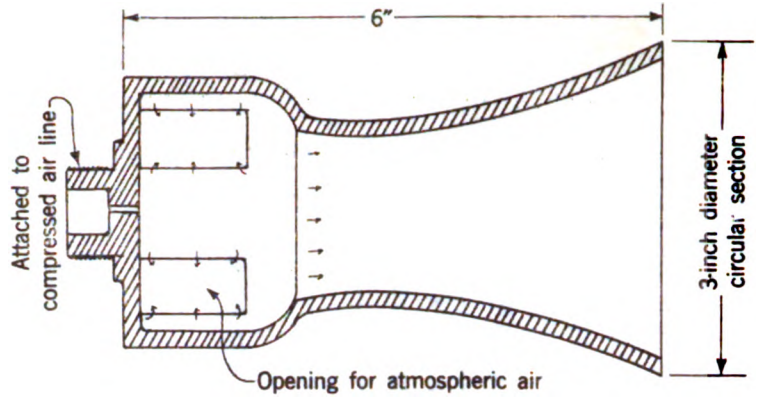

Figure 17.– Compressed-air blower nozzle

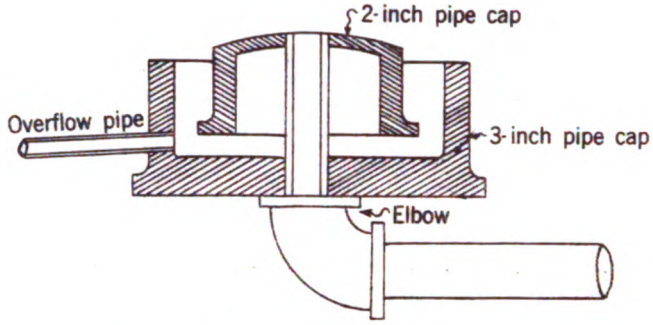

Figure 18 – Homemade drinking fountain

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